UNIVERSITY CURRENTS

A Newsletter For and About the University Nuclear Engineering and Science Community

U. S. Department of Energy *Fall 2003*

South Carolina State University Nuclear Engineering Students in South Africa

In March 2003, two SCSU Nuclear Engineering students (Justin Nelson and Patricia Glenn) and a faculty member (Tica Valdes) had the opportunity to attend the Generation IV International Forum Policy Group Meeting in Cape Town, South Africa. It was an experience that will not be soon forgotten. The event quickly became a shared experience in the excitement of the planning and debriefings among all faculty and students at SCSU, as well with industrial supporters during the Spring 2003 Industrial Advisory Council. The SCSU group did not know what to expect when they were invited to the Forum in South Africa, but were extremely pleased with the whole experience. The long flight was well worth the opportunity to see representatives from ten countries come together to address global policy for a future of safe, efficient and innovative generation of nuclear power.

DOE staff, and South Carolina State students and staff attended the Generation IV Forum (GIF) in the Republic of South Africa in March 2003. (Linsey McDaniel, DOE; Tica Valdes, Justing Nelson, and Patricia Glenn, SCSU.)

The SCSU group visited the Koeburg Nuclear Power Station, the only nuclear facility generating electricity in South Africa, which is owned and operated by South Africa's National electric utility, Eskom. It has two operating 920 MW PWR reactors, serving 8% of South Africa's demand for electricity. It has been in operation for ten years.

On March 18, the SCSU group attended the Generation IV International Forum Policy Group Meeting. The SCSU group was able to hear discussions on multilateral agreements, issues with information management, and developments in system evaluation criteria. They were also able to hear about several of the R&D Collaborations (e.g., the Gas-Cooled Fast Reactor, the Supercritical-Water-Cooled Reactor and the Very-High Temperature Reactor Collaborations, discussions led by the US, Canada and France, respectively). They spoke with several of the policy group members, telling them about the SCSU Nuclear Engineering Program and, in turn, learning a little about the role of nuclear energy in the different countries such as Japan, France, Spain, and many others.

The Generation IV International Forum Policy Group with the SCSU group (along the front row)

On March 19, the SCSU group took a short flight to Johannesburg, first stopping off at Potchefstroomse Universiteit, or POTS, meeting with Professor Willem van Niekerk from the Department of Mechanical Engineering and several of his graduate students. Professor van Nierkerk's group had designed and built the first closed-cycle, multi-shaft gas turbine in the world, demonstrating that a "three shaft recuperated Brayton cycle can be sustained and controlled" and that "it renders a stable operating configuration." The SCSU students were able to see concepts from the classroom come to life. The demonstration of the PBMR Brayton Cycle at POTS was a wonderful adventure. The students actually walked through the power conversion system.

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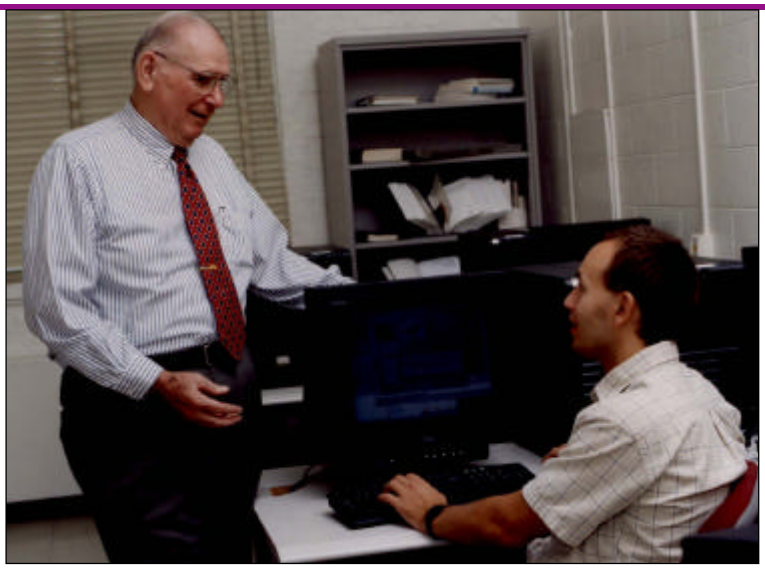
SPOTLIGHT

University of Tennessee's Bob Uhrig



Dr. Uhrig has taught nuclear engineering at the Universities of Florida and Tennessee

At one time Dr. Robert Uhrig thought he would open a bicycle shop or build a Volkswagen-powered kit airplane after retirement. Instead, he is helping to solve problems in nuclear power plants and other energy systems.

While he no longer teaches at UT, Uhrig continues to do research on a part-time basis, and his Distinguished Scientist Professor appointment allows him to split his work between UT and Oak Ridge National Laboratory (ORNL). His research for the past decade at both institutions has been the application of artificial intelligence technologies to complex systems.

"I am dedicated to helping with our country's energy problems," said Uhrig, "and I'm concerned about what we are doing about the generation of electricity and transportation fuels. As of now, there is no single best solution to our many complex, interwoven energy problems."

Most of Uhrig's research involves nuclear power plants, but he has also worked on other types of energy systems, such as the electric transmission grid and fossil and hydropower plants. He explains that the primary focus for this research is to understand how a system is operating; to detect, diagnose, and fix its problems; and, more importantly, to assure that it is operating safely and efficiently.

After graduating with honors from the University of Illinois in 1948, Uhrig began teaching engineering mechanics and entered graduate school at Iowa State University. In 1951 he switched his focus to the newly established nuclear engineering program and he began working at the Atomic Energy Commission's Ames Laboratory at Iowa State.

After earning his master's and doctoral degrees in theoretical and applied mechanics from Iowa State in 1950 and 1954, respectively, he was called up for service in the United States Air Force and was assigned to teach engineering mechanics at the U.S. Military Academy at West Point from 1954 to 1956.

Uhrig served as chairman of the Department of Nuclear Engineering at the University of Florida from 1960 to 1968, and then as the dean of the College of Engineering from 1968 to 1973. From 1973 to 1986 he was also vice-president for advanced systems and technology at Florida Power and Light.

Uhrig has been a consultant to the Nuclear Regulatory Commission (NRC and on the Advisory Committee on Reactor Safeguards. He also served on a National Academy of Science committee that investigated the 1986 Challenger shuttle explosion.

Uhrig taught nuclear engineering at UT from 1986 through 1998. After his retirement from 12 years in the classroom came Uhrig's "post-retirement employment"–the Distinguished Scientist Professor appointment, a four-year tenure that will end in December of this year.

Uhrig's research and his involvement with the NRC and other government safety committees have brought him many honors, including the Secretary of Defense Meritorious Civilian Service award in 1968, the ASME Richards Memorial award in 1969, the ANS Glenn Murphy award in 1992, and the Phi Kappa Phi medallion and distinguished member awards in 1997. He is also a fellow in the ASME, ANS, and AAAS technical societies.

During his off-time, Uhrig lives in Florida with his wife, Paula, and enjoys spending time with his seven children and many grandchildren.

(Continued from Cover Story)

On March 20, the SCSU group spent the day at the PBMR IST head office, the company spearheading the production of the PBMR. They were taken to Pelindaba and toured the Nesca Fuel Plant Laboratories. The group suited up in protective gear and was taken through the process of generation of the PBMR fuel, from uranium enrichment to final production of the pebble. No detectors were set off by our group at any stage of our visit.

Justin Nelson had several positive remarks about his adventure. "The experiences that I took from there were both educationally and emotionally gratifying. While I was in South Africa, I was able to see first hand all the hard work that goes into creating nuclear reactors. I was able to see a time line so to speak of how the German concept of the PBMR is starting to come to life in this century. I was also very impressed with the Power Conversion Unit at the Potchesfstroome University. Especially, how the entire unit was constructed in only nine months."

Mr. Justin Nelson went on to complete an internship this summer at Oak Ridge National Lab, hosted by Dr. Hamilton Hunter (Director for the Radiation Safety Information Computational Center, RSICC, at ORNL) and is currently in his junior year at SCSU. Ms. Patricia Glenn will be attending the University of Wisconsin during the spring of 2003 to complete core courses in nuclear engineering.

Nuclear Engineering Education Research Papers Presented at ANS Meetings

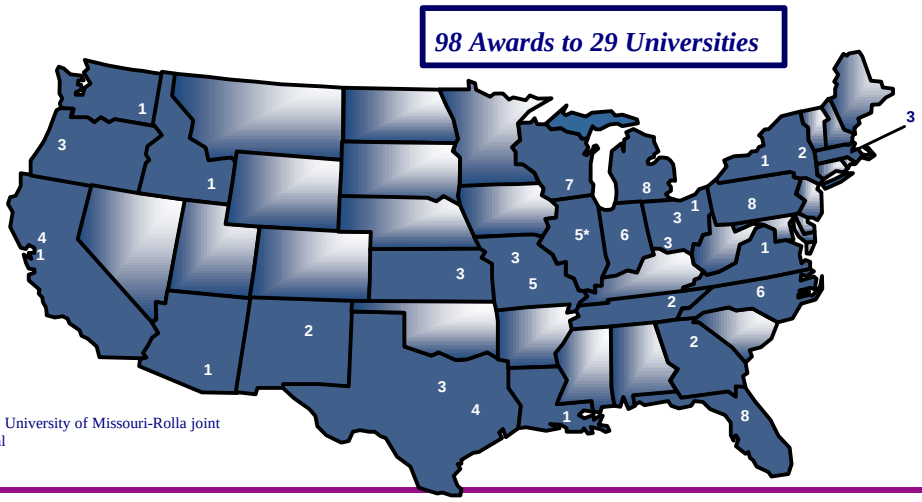
Over the past six years, the Department of Energy has funded 98 grants to 29 universities through the Nuclear Engineering Education Research (NEER) Grant Program. One venue that DOE has provided to the universities to present their research is through the American Nuclear Society Meetings.

The June 2002 Annual ANS Meeting held in Hollywood, Florida, was the first DOE-sponsored opportunity for principal investigators and students to present the results of their research. Three regular sessions and three special student sessions were held during the week with 37 papers presented. The sessions were well attended and opened the door for future presentations at ANS meetings.

During the 2003 Annual ANS Meeting held in June in San Diego, a student session was held and an award was presented for best paper. There were six outstanding papers presented during this session. Ms. Natala Ostrovskaya from Texas A&M University was the recipient of this award for her presentation entitled, "Modeling the Radiation Response of Respiratory Tissue."

The upcoming 2003 ANS Winter Meeting to be held in New Orleans will feature two NEER sessions on Thursday, November 20. There will be approximately fifteen papers presented between the two sessions. DOE encourages attendance at these sessions to hear about the new research being done at universities across the nation supported by the NEER Grant Program. The sessions are entitled *U.S. Department of Energy Nuclear Engineering Education Research: Highlights of Recent and Current Research -- I and II*.

College/University/Campus Proposal Combined Award Distribution for FY 1998, 1999, 2000, 2001, 2002, and 2003



*FY-02 University of Missouri-Rolla joint proposal

Lateral Migration Radiography Finds Flaws For NASA.

An exciting new application of lateral migration radio-graphy (LMR) is being developed by two Nuclear & Radiological Engineering Department faculty members, Drs. Edward Dugan and emeritus professor Alan M. Jacobs. The two have perfected the LMR technique to detect sub-surface defects in materials and structures for which there is no effective method for detection. Examples include delamination in layered composites, defects in coatings on metal surfaces in aircraft jet engine components and structural/composition changes on the inside of shell-like components with only outside surface area access.

Now the research is being conducted to assist NASA find hidden flaws in the coatings and surfaces of the Space Shuttle and its external fuel tanks. Drs. Dugan and Jacobs have already demonstrated that the LMR image signature is very effective for the detection and identification of buried land mines. This research was conducted for the US Army.

Drs. Dugan (l) and Jacobs view the underside of the LMR machine they developed to detect underground land mines for the U.S. Army. The technology is now being applied to find flaws in coatings and surfaces of the NASA Space Shuttle and its external fuel tanks.

Spent Fuel Storage Cask Modeling Assures Effectiveness. The University of Florida Nuclear & Radiological Engineering Department is providing research into simulation of real-life shielding problems by examining the properties of spent fuel storage casks. Historically, nuclear power plant designs included a spent fuel pool for temporarily storing about 10 years of their spent nuclear fuel. As a result, the Nuclear Waste Policy Act of 1982 mandated that the federal government begin centralized storage of spent nuclear fuel by 1988, but because of delays, the earliest possible date for centralized storage is set for 2010.

Figure 1: *Independent Spent Fuel Storage Installation.*

Currently the spent fuel pools of more than thirty five U.S. nuclear power plants have reached capacity, forcing the utilities to search for an alternate option such as dry spent fuel storage, shown in Figure 1. As utilities search for viable options, detailed three dimensional analyses of spent fuel storage casks can provide valuable insight into the design of these storage installations, shown in Figure 2. Analysis of current systems can aide in the optimal loading of the spent fuel storage installation in order to reduce external dose rates. This UF research is being undertaken by Dr. Alireza Haghighat and his graduate Student Daniel Shedlock.

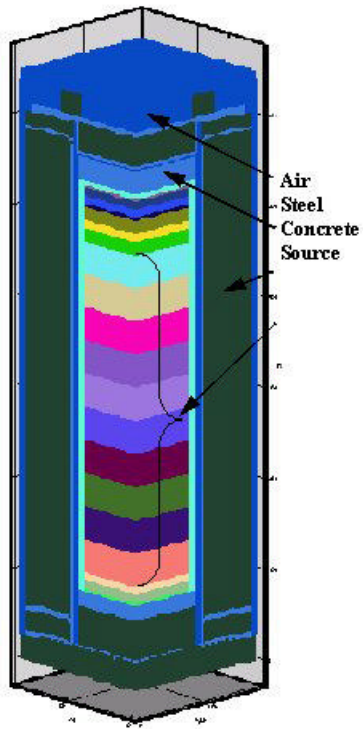


Figure 2: *3-D Discrete Ordinates Model of an Independent Spent Fuel Storage Installation.*

New UF Recruiting Techniques Increase Enrollment in Nuclear. The Nuclear & Radiological Engineering Department has embarked on an aggressive campaign to recruit excellent students. This campaign includes the following:

- Prepared a comprehensive departmental CD that gives a colorful presentation of NRE research, projects and faculty, along with information on scholarships and programs. The department is communicating with alumni to recruit them in the effort to help with distribution of this CD in local area high schools.

Continued from Page 4
(University of Florida)

- Established scholarships to attract outstanding students and to reward excellent student achievement. These scholarships include the Pagano Scholarship and the FPL Elite Nuclear Engineering Scholarship. Other sponsors are being solicited.
- Organized one-day tours of the department and its facilities for high school students. In one example, more than 40 advanced placement and honors science students from Jacksonville's Fernandina Beach High School visited with three guides and teachers. They toured the UFTR and heard presentations from five professors about nuclear energy and other associated radiological careers. The tour included an irradiation demonstration by Dr. Bill Vernetson, presentations by Drs. Ali Haghighat, Wesley Bolch, David Hintenlang and Dave Gilland, plus a long visit to the computing lab.
- The department is establishing effective communications with all high schools in the state. Thus far, NRE has sent more than 1,000 posters and CDs to high schools across Florida. A reply card was included for setting up tours of the department and for arranging visits to the UF Training Reactor. Last year, an undergraduate poster was developed and sent to science teachers at all high schools in the state.
- Revised the format of the Introduction to Engineering course by maximizing the effectiveness of dialog through which the students become more familiar with the benefits of Nuclear & Radiological Engineering. This is accomplished by raising and discussing four key questions about the department and its curriculum. NRE discovered this introductory class can be a very effective recruiting tool (and also important for department publicity), as many students are at a point where they are seeking to firm up their career plans. More student outreach and recruiting activities are planned.
- NRE is preparing a poster for graduate recruiting. The poster highlights many department research programs and lists degrees, research areas, facilities and institutes associated with NRE. The poster is planned to be sent to key Physics and Nuclear Engineering departments at the premier colleges around the nation.
- To date, department recruiting has resulted in a 30%+ increase in enrollment last year, and the same 30%+ enrollment increase is expected for the coming school year. Total department graduates and undergraduates now number 130+ students.

The Radiochemistry Education Award Program (REAP)

REAP was initiated by DOE-NE in 1999 to stimulate the education and training of scientists and engineers with expertise in radiochemistry. Manpower studies have shown that there is increasing demand for radiochemists due, in part, to the retirement of senior expertise developed in the early days of nuclear programs, which is concurrent with declining graduation rates. To address this concern, the DOE initiated REAP-I which, through a competitive process, funded three universities (Clemson University, University of Missouri-Columbia and Washington State University) for three years. Due to the success of REAP-I, a second program (REAP-II) was initiated in 2002. In the second program, Colorado State University, the University of Texas at Austin, Clemson University, and Washington State University received support with similar goals to the initial program.

REAP awardees have used a combination of approaches to accomplish their respective objectives: interdepartmental collaboration, new faculty hires, collaboration with DOE facilities, new laboratory equipment, and student financial support. These strategies have increased the number of multi-departmental research programs at each institution recognizing the benefit of collaboration among the engineering, scientific and medical communities. Recognizing a serious need is being addressed, scientists at DOE's national laboratories have been very supportive of the program and the increased collaboration with REAP institutions. Overall, the results of the program have been dramatic.

For example, Clemson has built a collaborative program with support from several governmental programs. In the first two years, their activities were focused on establishing the environmental radiochemistry specialty within Clemson's Department of Environmental Engineering and Science. These activities included: hiring a new faculty member, developing the environmental radiochemistry curriculum, developing an actinide chemistry course, student recruitment, the addition of new laboratory space, and the acquisition of equipment to support both the instructional and research programs. Currently, 12 students are conducting research in Environmental Radiochemistry and Radiochemistry and three undergraduates are receiving support as part of the Undergraduate Enrichment Program (which attracts high quality students to the radiochemistry graduate program). In excess of $2M of sponsored research is currently underway in support of DOE missions at SRS, Hanford, INEEL, DOE/NETL and DOE/EMSP. Intern positions have been identified at DOE-EM sites with a dominate focus on cleanup. A post-doctoral researcher will be added to the program in mid-2003.

At the University of Missouri-Columbia, the program is administered by a collaborative effort between the Nuclear Science and Engineering Institute and the Chemistry Department, with an advisory board of individuals from ANL and LANL. To address instructional needs in Radiochemistry, a combined Radiochemistry/ Radiation Detection course is being offered (with last semester's enrollment of 34 students), students are being advised to take nuclear science courses outside of their major field of study, and new courses on actinide chemistry are being developed. A new faculty member, Dr. Paul Duval, with expertise in actinide chemistry was hired through the availability of REAP funds and a second faculty member in environmental chemistry is currently being recruited. Dr. Duval has been on campus for two years and now has his laboratory functioning with a new glove box, associated containment system to allow research use of actinides and new detection systems including a PERALS Alpha Spectrometer. Activities during the past year include visits to MU by seven DOE scientists/managers from ANL, LLNL, LANL, Bettis and INEEL. These interactions were focused on joint research programs and informing students of career opportunities at the various facilities. Three follow up visits

and research activities have occurred at DOE facilities. A total of eight graduate students have received funding from this program and most have been involved in internships at national laboratories.

Washington State University also used REAP funds to hire a new faculty member and grants from other DOE programs allowed the addition of a post-doctoral associate. The Radiochemistry Program at WSU has been assigned three additional laboratories and a fourth room for counting in Fulmer Hall to accommodate the new faculty member who was also assigned additional counting and research laboratory space at WSU's Nuclear Radiation Center. Major equipment purchases include three high purity germanium detectors, associated low-background shielding and electronics, a 24 unit alpha spectrometry system and an inductively coupled plasma optical emission spectrometer. A PQ Excel ICP-MS system equipped with the S-option for increased sensitivity and an autosampler were purchased for measuring long-lived radionuclides and trace metals. Curricular additions include a radiochemistry course in neutron activation analysis, the integration of radiochemistry topics into the undergraduate chemistry curriculum and integration of INEEL training needs into the radiochemistry program. Internships have been developed with PNNL, INEEL, LBNL, and LANL and two of the students have completed internships at PNNL under these arrangements. A four-week summer training program for regional college faculty will be established to provide faculty who are teaching undergraduates in the physical sciences and engineering more in-depth knowledge of radiochemistry. The desire is that through this process the faculty will include more information in their courses that relates to radiochemistry and thus stimulate student interest in pursuing a graduate degree in radiochemistry.

Colorado State University received REAP II funding in May 2002. As a result a new radiochemistry track was developed and approved for the 2002-2003 school year. Three excellent students were recruited for the MS program and began class work during the 2002-2003 school year. These students are receiving full financial support (stipend and tuition) through the REAP-II grant. All three students did an internship at the Carlsbad Environmental Monitoring and Research Center during the summer of 2003. Arrangements for internships have also been discussed with LANL, SREL and LANL with all expressing interest in hosting CSU students.

The University of Texas at Austin's Nuclear and Environmental Programs also received REAP II funding in 2002 and, as a result, recruited and hired Dr. Steven Biegalski from Veridian Systems, who has extensive experience in radionuclide detection. Four students have taken summer internships at LANL, ANL and BNL and four undergraduates have received partial support from REAP and from other sources. Funding from REAP is being used in conjunction with INIE and DOE National Lab funds to support new initiatives with graduate students in the radiochemistry area. A new course in Nuclear and Radiochemistry is being developed and will be presented for the first time in the fall of the 2003-2004 school year. The course will include lectures and laboratories. The course will be taught from a distance learning lab and can be seen simultaneously on the internet or viewed later depending on the student's desires.

Overall, as a result of the REAP program, new faculty have been added, laboratories refurbished and upgraded with new instrumentation, the number of graduate students with a focus on radiochemistry has increased substantially, new linkages have been established with DOE facilities including internships for students and new research programs funded. The REAP program is having the desired affect of increasing the number of faculty and graduate students in radiochemistry with the end result of more graduates being generated to address the needs of DOE and the nuclear community.

Office of Nuclear Energy Science and Technology's University Programs Sponsors Summer Interns at ORNL

Justin Nelson, who has been in a dual degree program at South Carolina State, is soon to attend the University of Wisconsin at Madison to obtain his Master's degree in Nuclear Engineering. "I began as a Biology major," he says, "but we got a new Nuclear Engineering program at South Carolina State. I took the ultimatum. At the time, I didn't really know much about Nuclear Engineering, but as I went along, I liked it."

Justin Nelson of South Carolina State with mentor Hamilton Hunter, RSICC Director

During his undergraduate education, Justin has been able to take several tours, including one at ORNL last year, and each experience has helped him to learn more about his field of interest. He was particularly pleased to be invited on a tour of South Africa with the Department of Energy, Office of Nuclear Energy, Science and Technology, where he "got to see the Pebble Bed Modular Reactor they are developing in Johannesburg." Getting to see the PBMR close up made him "want even more to go into nuclear energy," he says.

Justin, whose work is sponsored by NSTD's **Nuclear Engineering Student Laboratory Synthesis (NESLS) program**, saw a reactor from a computer's perspective this past summer as he modeled the safety of control rooms during accident scenarios. His mentor was Hamilton Hunter (Nuclear Data and Information Analysis Group and Director of the **Radiation Safety Information Computational Center**).

Justin explained his project: "I am modifying a control room habitability code called tact5 which stands for Transport of ACTivity. The code is used to calculate the flow of nuclides through a group of nodes in a plant and the associated release rates of activity of each nuclide to the atmosphere. the code is apart of the Habit program, which also consists of other code such as FPFP, Extran, and Conhab. I take the outputs given by the code and do spot checks to compare results.

"While learning about the code, I also increased my knowledge of nuclear disasters such as Three Mile Island and Chernobyl. This showed me the need for such codes and the elaborate safety precautions that are needed when using nuclear energy."

His mentor is able to find his own student days useful in his role as a mentor. Hamilton says, "When I approach students, I go to my own past experience: I was mentored at a nuclear power plant. That experience helped me relate to Justin." Hamilton adds that "Justin is very capable. I'm very happy to see how the meat of his academic experience played out in this environment.."

A Senior at Tuskegee University, ***Mac Weatherspoon*** has now completed a B.S. degree in Aerospace Engineering and is returning to complete his course requirements for a second B.S. degree in Physics. He's planning to go on for a Master's degree, but he hasn't yet made up his mind about where he's going—or what his major area of study will be. "We're trying to sway him," says Nuclear Data and Information Analysis Group Leader Bernadette Kirk, "to go into Nuclear Engineering."

MacAuthur Weatherspoon of Tuskegee University with mentor Jy-An Wang

Mac's summer work at ORNL was sponsored by NSTD's **Nuclear Engineering Student Laboratory Synthesis (NESLS) program**. His Mentor, Jy-An

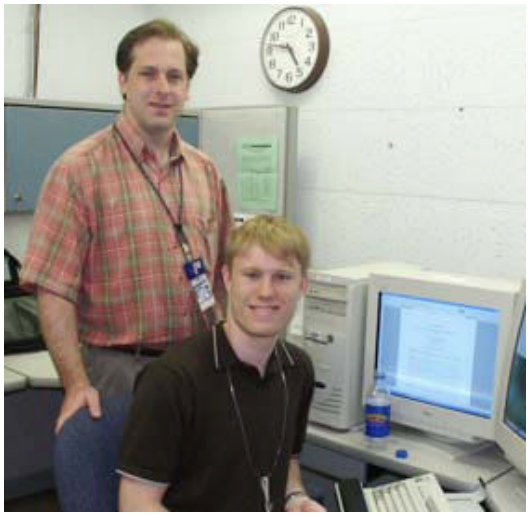
(John) Wang, said his student was "very self-motivated." Dr. Wang hoped to give Mac "a new perspective" by offering him the opportunity to undertake some "independent research in nuclear engineering." He says "Mac recognized that it's not an easy topic, but he was willing to undertake it." Mac's contributions will be of real help to his mentor's work as well: "We actually have a potential proposal for which he was able to help us by doing the groundwork."

Working at ORNL also allowed Mac the opportunity to work with state-of-the-art equipment. His mentor explains that Michael Wu, who also works at ORNL, offered Mac a chance to visit and work in his laboratory.

Mac is currently doing "research on nuclear fuel for space applications." He explained that he specifically researched the new CERMET fuel, a "really new concept" about which there isn't much available yet in the way of design. Mac looked into the current literature to compile as much information as possible. "Rockwell," he mentioned as an example, "has designed CERMET fuel. They've put holes through their fuel, and theirs isn't cladded—it's for electrical propulsion." It's those design variations on a new concept that was his research focus.

Mac says he's "laid back" when he's not hard at work. "I watch TV, work out—and I just began working out more." He lived in West Knoxville, but he came all the way from California to attend Tuskegee in the Southeast.

ORNL is a member of the consortium supporting the International Reactor Innovative and Secure (IRIS) Project that is being led by Westinghouse. ***Allan Wollaber's*** project consisted of the application of the FORMOSA-P core loading optimization code to the preliminary IRIS core design to obtain a design that, Allan explained, uses burnable poisons such as Gd and Er to improve safety and longevity for the first cycle core loading. In addition, he performed calculations that will be used to determine an equilibrium two-batch core design that can be used for the subsequent fuel cycles. Both of these core designs will then be used for the preliminary design of IRIS and to support NRC licensing activities.



Allan Wollaber of the University of Tennessee, Knoxville, with mentor Jess Gehin

Allan, who received his Master's degree from the University of Tennessee, Knoxville, this past summer, found his work with Mentor Jess Gehin (Radiation Transport and Physics) very rewarding. "Just being in that environment," he says, "helped me gain so many tools to speed up tasks. I'm very grateful for the opportunity."

Jess adds that "Allan was able to learn a lot about the practical things we do here at the Laboratory, as opposed to only theoretical research." Allan's Master's thesis was based directly on his work with the IRIS project, and he finished up his work this summer after coming to ORNL in November, 2001. This fall, Allan headed to the University of Michigan to begin pursuing his doctorate in Nuclear Engineering.

Felicia Gilliland is a Senior at Oak Ridge High School. She learned many new computer skills this past summer with the help of her mentor, Jennie Manneschmidt, **Nuclear Data and Information Analysis Group**.

Felicia Gilliland, s Senior at Oak Ridge High School

Felicia was familiar with computers, and even has her own **website**, but she increased her expertise by using various computer operating systems, including Linux, Unix, and Windows. One of her tasks this summer was to turn various files into HTML for the Web, says her mentor. "One of our data packages, SINBAD, is a benchmarking tool," she explains, "and Felicia converted the SINBAD files for us."

After she graduates next year, Felicia plans to attend a college in North Carolina where she plans to pursue a degree in PreMed in hopes of becoming a pediatrician. In her spare time, she enjoys volleyball, basketball, and softball, and Felicia also works as a volunteer counselor at Girls, Inc., an Oak Ridge organization similar to the Girls' Club.

University of Wisconsin -- Two Birthdays

Almost eight years ago, the Department of Nuclear Engineering and Engineering Physics merged with the Department of Engineering Mechanics and Astronautics. This successful departmental merger, unique in its own right, signaled a beginning of a new era and continued an evolutionary path for the nuclear engineering program and degree. In the summer of 2003 we were pleased to celebrate the beginning of the nuclear engineering program which originated almost a half-century ago.

In mid-1950's under the leadership of Dean Kurt F. Wendt in the UW College of Engineering, meetings were held regarding the establishment of an educational program in nuclear engineering. Instigated by discussions between Dean Wendt and Dean Everett at the University of Illinois in 1954, an ad-hoc nuclear engineering committee was formed with Profs. Barker, Bird, Higgins, Rohlich, Roark, Uyehara and Weber as members. In early meetings, in 1955, the committee examined the report of Prof. Frank Myers, chair of Physics at Lehigh University and a consultant for Argonne National Laboratory, which suggested a complete educational program structure and cost in nuclear science and engineering. This committee and its interest in the discipline was the birthplace of nuclear engineering at University of Wisconsin, Madison.

The activity in nuclear engineering in the college then grew quickly:

- 1957: Dr. Max Carbon was hired as a faculty member in Mechanical Engineering and was tasked with forming the program.
- 1958: A Masters of Science in Nuclear Engineering was offered in the College of Engineering as a committee degree.
- 1960: The UW Nuclear Research Reactor was built and given a forty year license by the Atomic Energy Commission
- 1962: A Doctoral degree was offered in nuclear engineering was also offered in the College of Engineering.
- 1963: The Nuclear Engineering Department was officially formed and a Bachelors of Science in Nuclear Engineering was offered by the department with a focus in fission reactor engineering.

Since that first decade, the department has aggressively expanded its vision of what nuclear science and engineering encompasses. In the 1960's the faculty began graduate research and education in plasma physics and fusion, particle accelerators, radiation damage of materials as well as superconductivity and cryogenics. This broad vision and scope can be attributed to the leadership of Prof. Carbon as well as the cooperation and collaboration of a unique set of faculty in the college nuclear engineering committee as well as the new faculty in the department.

To celebrate the beginning of the nuclear engineering masters degree in 1958 and the beginning of the undergraduate degree and department five years later, in 1963, the department will have a special celebration during Engineers Day on October 17-18, 2003.

The University of Wisconsin Energy Policy Forum

The Future of Nuclear Energy in Wisconsin (October 22-23rd, 2003: Monona Terrace Convention Center)

Wisconsin faces a future energy crisis. The State's most recent energy policy predicts a 6,300 MW shortfall by 2016, the equivalent of roughly 12 large centralized electrical generation plants. Moreover, Wisconsin's current generating capacity is very old – the newest of its 15 large coal-fired plants are more than 30 years old and most are between 40 and 70 years old. The existing nuclear fleet is between 25 and 30 years old and is likely to be relicensed within the next decade. Finally, there is limited existing import capability and ongoing debate about additional transmission lines to enhance this capability.

Point Beach Nuclear power Plant, Two Creeks, Wisconsin

At the same time, Wisconsin's options for new energy sources are limited. The state currently does not allow new nuclear plants to be built and new transmission lines face stiff resistance. The consequences of failing to address this future energy shortage could be staggering to the state's economy.

The Energy Systems and Policy faculty have a mandate to pursue the Wisconsin Idea by engaging in the State's energy policy debate. A group of faculty have organized a two-day forum to inform and educate key decision makers (legislative, business, civic and religious), environmental organizations, teachers, students, and the public on the difficult issues involved in the State's energy policy. The forum will also serve to introduce a year-long program of outreach and education activities aimed at engaging policy-makers with the specific issue. A forum of this nature is sure to increase the role played by the University in State energy policy development and possibly in regional and national energy policy.

For this first year, the topic will be "The Future of Nuclear Energy in Wisconsin". We believe the State must give serious attention to utilizing nuclear energy for generating electricity in plants built after those currently under regulatory review and approval. New nuclear power plants represent an economically attractive low emission (not only on CO_2, but also sulfur-oxides, nitrous-oxides, particulates, and mercury releases) electricity generation technology and will help Wisconsin compete in the emerging economy of this new century.

Following on the success of this forum, an annual event is envisioned to address various specific issues emerging from many general energy policy topics being addressed by UW-Madison faculty and scientists: capacity for alternative energy technologies, the cost of unreliable energy systems, sustainability metrics for energy systems, the impacts of atmospheric emissions, or the role of Wisconsin in the transition to a hydrogen economy.

The conference program and registration information can be found at the website: http://www.engr.wisc.edu/ep/NE_conf_program.html

Department Leads Effort to Increase the Ranks of Nuclear Science College Majors

A new national survey of 400 high school teachers confirms what we have known for far too long: high school science teachers have precious little knowledge of nuclear engineering, science and technology.

The results of the study sponsored by DOE's Office of Nuclear Energy, Science and Technology, through a subcontract with ANS, will be used as part of a national awareness effort to enhance the number of high school and college students who consider nuclear engineering and sciences as college majors and careers.

The quantitative research study surveyed high school science teachers nationwide to understand: key assets high school science teachers use when recommending college majors and careers; the depth of knowledge high school teachers have of these fields; the depth of knowledge high school students have, according to their teachers, of these fields; and, to understand how to more effectively communicate with high school teachers to better inform them of these fields.

Results showed that only *16 percent* of teachers nationwide are familiar with nuclear engineering, science and technology. Further, the teachers believe that only *3 percent* of high school students are familiar with college major and career possibilities in these fields. Other findings showed:

- Key assets colleges and universities should possess for high school teachers to recommend them to students are: student access to faculty; availability of a specific major; availability of financial aid; full time faculty teach the majority of classes; and, strong placement services for graduates.
- 62 percent of teachers surveyed would like more information on these fields, specifically via an electronic newsletter or website.
- 91 percent of teacher respondents use the Internet regularly for an average of 8.8 hours per week.

These data will be analyzed with similar studies in the past to give market researchers a clear picture on the image of nuclear engineering and sciences, and then help us develop and implement a national campaign that targets high school science teachers to increase the image, reputation and visibility of these fields.

The next step is to convene a "Nuclear Energy, Science and Technology Awareness Team" that includes representation from the Department of Energy, the American Nuclear Society, industry and higher education. This team will be asked to work on the design and implementation of a national knowledge effort that targets high school teachers. A key first goal will be to find creative and cost effective ways to better inform high school teachers on the importance, value and opportunities in nuclear science, and then find ways to share our knowledge with colleges and universities and better coordinate all of our outreach efforts.

You will be kept informed of the progress of this most important effort.

New Graduate Studies in Radiochemistry at Colorado State University

Radiochemists are in high demand for occupations in Nuclear Energy Programs, Environmental Restoration, Nuclear Waste Management, National Security and Nuclear Medicine. Colorado State has been recruiting students, beginning in Fall 2003, with a B.S. with a grade point average of 3.0 or above and completion of basic courses in chemistry, physics, biology and calculus. Students with strong background in analytical and physical chemistry and minority students are encouraged to apply. Several fellowships are available to qualified students through a grant from the U.S. DOE. Financial support includes $1,200 monthly stipend and tuition. Program requirements include courses in radiochemistry, analytical chemistry, radiological physics, nuclear measurements, radiation biology, radiochemistry summer internship and electives. A minimum of 30 credits is required for the M.S. degree which can be completed by strong students in one calendar year.

For information about the above program, contact:

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DOE Fellowship Recipient Joins with INEEL Team to Pursue New Nuclear Technology

The Department of Energy's Idaho National Engineering and Environmental Laboratory is leading research in several Generation IV nuclear reactor concepts. That's why Nathanael Hudson chose to spend his summer there. He wanted to help develop the next generation of nuclear power technology – something he strongly believes in.

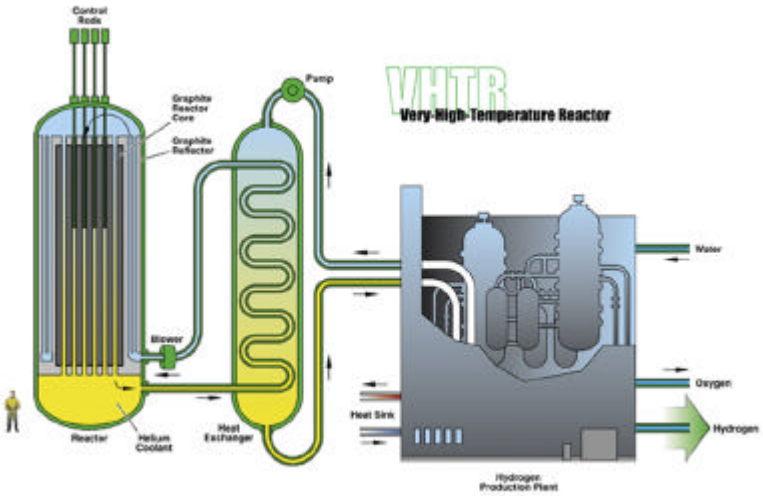
Hudson, of Jacksonville, Alabama, is a doctoral student in nuclear engineering at the Georgia Institute of Technology. A Department of Energy Nuclear Engineering/Health Physics Fellowship is funding his schooling, and he is at the INEEL fulfilling practicum requirements for the fellowship. With a master's degree in mechanical engineering, Hudson decided to pursue a doctorate in nuclear engineering because he perceived the beginnings of a renewal in the field.

"There seems to be a renaissance in the nuclear power industry right now," he said. "I wanted to be involved in it."

Hudson is working under the guidance of Dr. Abderrafi Ougouag, his mentor, and he works closely with nuclear engineers Charles Wemple, William Terry and Hans Gougar. Hudson has taken advantage of this ready source of knowledge.

"This is a national lab, and no matter how difficult your question is, you can always find someone to answer it," he said.

The team of engineers is developing a Pebble Bed Very High Temperature Reactor to form the power production portion of the New Generation Nuclear Plant (NGNP), one of several Generation IV nuclear power concepts being pursued at the INEEL. The NGNP will produce electrical energy and hydrogen. Hudson's job is to combine existing computer codes to prepare cross-section libraries of elements being considered for building the reactor. These cross sections are necessary input to the codes used to design and monitor reactor cores.



This summer, the INEEL's Nuclear Energy organization is hosting 19 student participants and a faculty member on sabbatical leave. An additional five students and three professors remain at their institutions performing collaborative research projects associated with INEEL programs. This is an increase in fellowship participation from what the Nuclear Energy organization has seen in previous years, and echoes the rise in nuclear engineering student enrollment around the nation. It is the hope at the INEEL that word of mouth by the students and visiting faculty members will further increase the laboratory's attractiveness to students.

The resurging interest in nuclear power research within the academic community has heartened Nuclear Energy System staff about the future of the Nuclear Energy program.

"A requirement for the future of nuclear power is having bright, interested and involved people contributing to the research of this important technology," said Kathryn McCarthy, INEEL director of Nuclear Science and Engineering. "As the lead nuclear energy laboratory for the DOE, the INEEL offers tremendous opportunities to contribute to the development of nuclear energy and add to the energy security of our nation."

Ougouag has mentored many interns over the years, and said it has been a rewarding experience. "They are a pleasure to work with, and with rare exceptions, rather brilliant," he said.

Hudson plans to use his research results from this summer in his dissertation.

U.S. Department of Energy and Industry Matching Grant Program Celebrates a Decade of Success

The U.S. Department of Energy's Office of Nuclear Energy Science and Technology with co-sponsorship of nuclear utilities, vendors, architectural-engineering concerns and other services providers have been providing support to university nuclear engineering programs since 1993. This support began with an agreement between Commonwealth Edison (now Exelon) and DOE. Over this ten year period approximately 20 million in funding has been provided to nuclear engineering programs. These funds have principally gone to support undergraduate scholarships, graduate student fellowships, student research projects, seed funding for faculty research, capital improvements, equipment purchases, and other features that support nuclear engineering education.

This program is a testament to the broad-range of interests that are concerned about the maintenance of viable nuclear engineering programs in the United States. In 1993, nuclear engineering education was about to complete twenty-years of declining enrollments, a decreasing number of programs, while the academic programs were undergoing an evolving transition from power-oriented programs to waste management-oriented programs. Nuclear engineering, which at one time was considered to be an elite engineering program, was suffering from a lack of new technology interests and the emergence of new elite programs in computer and medical technologies. Given this scenario the nuclear industry and DOE created a partnership to have a directed program designed to bring about a revival in nuclear engineering education. The DOE/Industry Matching Grant program over the past ten years has been a significant contributor to the current situation, which shows a dramatic increase in enrollments, the beginning of new programs and renewed interests in emphasizing new power reactor systems.

At the 2003 Winter Meeting of the American Nuclear Society two panels of university and industry representatives will be describing the successes of the DOE/Industry Matching Grant program. The 16 programs and their sponsors presenting at this conference will provide details on how ten years ago one utility and the willingness of the government established a new direction for nuclear engineering education. This new direction has incorporated most programs in the United States offering a nuclear engineering curriculum and over thirty industrial sponsors.

University of Wisconsin Professor Comes to INEEL to Boost Curriculum

Professor Robert Witt is taking the next year off from teaching at the University of Wisconsin to do state-of-the-art nuclear technology research. His experience will help beef up curriculum in the university's nuclear engineering classes.

Dr. Witt chose to do a sabbatical at the Department of Energy's Idaho National Engineering and Environmental Laboratory because of the lab's role as the leader in nuclear energy development – particularly its emphasis on Generation IV nuclear reactor development.

"I've been interested in making a contribution to these Generation IV reactors," he said. "So this is the place to be."

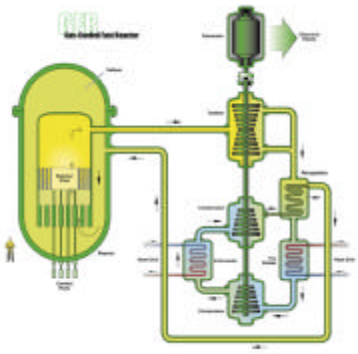
Witt will be working closely with a team of INEEL engineers led by Kevan Weaver developing the Gas-Cooled Fast Reactor (GFR).

With Witt's background in thermal hydraulics, structural mechanics and nuclear science, he will evaluate GFR safety system designs for fluid containment considerations. Weaver said he expects Witt's experience to be invaluable in furthering development of the project.

Witt plans to take what he learns back to Wisconsin to enhance teaching curriculum.

"A lot of my research will end up in advanced reactor technology classes," he said.

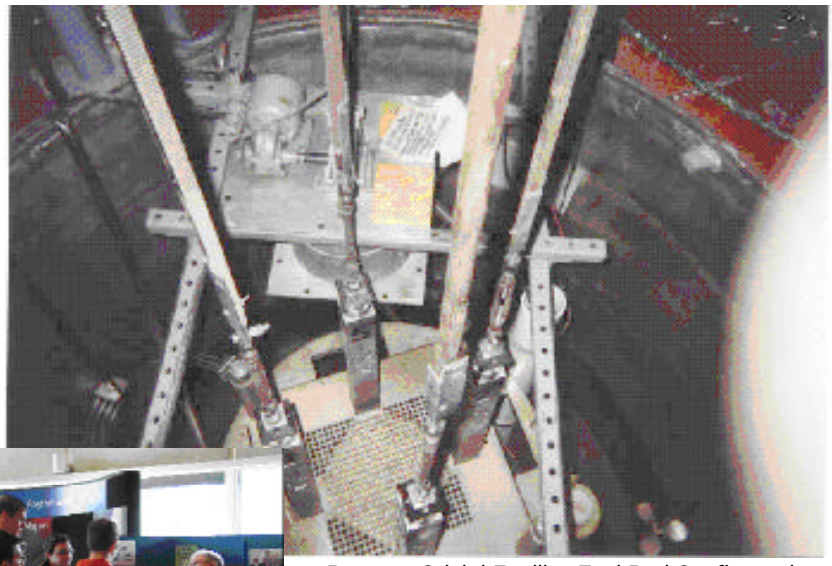
In the last two years, Witt has seen the university's nuclear engineering program enrollment double, partly, he thinks, due to a renewed awareness of the need for clean reliable energy sources. The value of teaching Generation IV concepts is that it shows the students we're thinking ahead for long-term energy solutions, he said.



Witt will complete his sabbatical at the INEEL and return to the University of Wisconsin in August 2004.

The Nuclear Energy Education Program News at Rensselaer

- Consistent with programs around the country, Rensselaer's Nuclear Engineering and Engineering Physics program has experienced significant growth in enrollments over the past several years. Spring 2003 enrollment numbered 116 undergraduates and 30 graduate students. Rensselaer's NEEP program offers both undergraduate and graduate degrees in Nuclear Engineering and Engineering Physics. Because of significant overlap between these two curricula, many students choose to obtain dual degrees in both disciplines. New to our program this year is a dual major option offered in Nuclear Engineering and Mechanical Engineering, which is attracting new students. Also, by offering a special introductory course in Nuclear Engineering and Engineering Physics designed with undecided majors in mind, RPI's NEEP program encourages students with little prior knowledge of the subject to consider our program. This one credit course is team taught by our faculty, and offers students an overview of current research as well as field trips to labs and research facilities both on campus and off. (Attached are photos of students at RPI's Reactor Critical Facility, a low power teaching reactor, where students are able to gain hands-on experience in running experiments.)



Reactor Cricial Facility Fuel Rod Configuration

Students with Chuck Vincent at ANS Conference

Drs. Xu and Naessens

- 36 students were inducted this Spring into Rensselaer's chapter of Alpha Nu Sigma. The national honor society was established in 1979 by the American Nuclear Society to recognize high scholarship, integrity, and potential achievement in applied nuclear science and nuclear engineering.
- Dr. Yaron Danon has recently been awarded a three-year $584,000 grant from the Stewardship Science Academic Alliance Program (a unit of the U.S. Department of Energy) to obtain new information on the fission process in small actinide samples. The grant will be used to conduct experiments that will combine the high neutron flux available inside a Lead Slowing-Down Spectrometer with high accuracy measurements of fission fragment distributions achieved with a double-gridded fission chamber. This method will extend the current measurement capabilities to smaller samples (sub-micrograms) or to smaller cross-sections (micro barns). Detailed measurements of the fission cross sections of actinide samples will be done and at the same time provide energy, mass, angular distributions (between fragments), and in some cases, charge distributions of the fission fragments. The RPI Lead Slowing-Down Spectrometer is a unique facility and is the only Lead Slowing-Down Spectrometer in the United States. The advantage provided by the Lead Slowing-Down Spectrometer is a very intense neutron flux, which rivals state of the art spallation neutron sources.
- Baodong Wang, a nuclear engineering doctoral student working with Dr. George Xu, has won the Burton J. Moyer Memorial Fellowship from the Health Physics Society. The fellowship includes an award of $6,000 and is accompanied by a travel grant to be used in attending the HPS annual meeting. The fellowship is the highest honor bestowed on a graduate student in Health Physics. Each year, only five awards are made nationwide.

University of Illinois: Summer Camp

Summer is normally quiet on the University of Illinois campus, as undergraduates go off to summer jobs, travel, and play. Not so North of Green Street, where the college students are replaced by high school students eager to learn about what engineering is, and why it might be a good future for them.

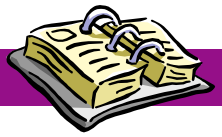
Exploring Your Options is a week-long residential program that introduces high school students to the field of engineering. Held at the University of Illinois at Urbana-Champaign, participants interact with engineering students and faculty, plan and build a project, and engage in hands-on activities in various engineering departments.

The Department of Nuclear, Plasma, and Radiological Engineering's (NPRE) three paths of study include nuclear power generation, plasmas and fusion, and radiological engineering and medical physics.

This year for the WorlDwide Youth in Science and Engineering campers, NPRE held two activities.

In the Nuclear Engineering Lab (NEL), campers received a short course on basic plasma engineering, from manufacturing and lighting to fusion electrical power production. There were demonstrations, including an experiment of plasmas interacting with magnetic fields. Then students broke into teams of two for a hands-on design and testing of a magnetic field coil to simulate the magnetic forces used in confining plasmas in fusion reactors.

In the CAVE, students saw how the CAVE is used in virtually modeling various operations of a power plant. After a brief description of how visual perception works, students experienced virtual reality in this state-of-the-art facility. They participated in interactive demos covering 3D visualization of the microscopic world, a simulated prototype nuclear reactor control room, and a demo that simply stunned everyone who enjoys video games.



Important Dates to Remember

2003

- Deadline for receipt of NEER proposals
  November 12, 2003
- American Nuclear Society Meeting
  November 15-20, 2003
  New Orleans, Louisiana
- Deadline for receipt of URI proposals
  December 5, 2003

For Additional Information Please Contact

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